

**U.S.ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY  
540 S. MORRIS AVE., MONTGOMERY, AL 36115  
GAMMA ANALYSES**

**REPORT OF SAMPLE DELIVERY GROUP #1200002**

Project: Dimock Residential GW Site, Dimock, PA  
Analysis method: Gamma Spectrometry  
Report ID: 1200002-GAMMA  
Report type: Original  
Date reported: 04/03/2012  
Total pages in report: 23

**SAMPLES**

NAREL Sample #	Client Sample ID	Location	Matrix	Date Collected	Date Received
B2.02559T	FB19	PA:DIMOCK	WATER-DRINKING	03/05/2012	03/07/2012
B2.02560K	HW56	PA:DIMOCK	WATER-DRINKING	03/05/2012	03/07/2012
B2.02561L	HW60	PA:DIMOCK	WATER-DRINKING	03/05/2012	03/07/2012
B2.02617K	FB20	PA:DIMOCK	WATER-DRINKING	03/06/2012	03/08/2012
B2.02618L	HW61	PA:DIMOCK	WATER-DRINKING	03/06/2012	03/08/2012
B2.02619M	HW61Z	PA:DIMOCK	WATER-DRINKING	03/06/2012	03/08/2012
B2.02675W	FB21	PA:DIMOCK	WATER-DRINKING	03/08/2012	03/09/2012
B2.02676X	HW50	PA:DIMOCK	WATER-DRINKING	03/08/2012	03/09/2012

**EXCEPTIONS**

1. **Packaging and shipping** – No problems were observed.
2. **Documentation** – No problems were observed.
3. **Sample preparation** – No problems were encountered.
4. **Analysis** – NAREL normally assumes that the radon daughter nuclides Pb-214 and Bi-214 in environmental matrices are in equilibrium with Ra-226 and therefore decay corrects the concentrations of those nuclides using the 1,600 year Ra-226 half life. For this project, the results of gross alpha/beta and radium analysis are inconsistent with that assumption, and the observed decay rate between replicate gamma analyses of the same aliquant performed on different days indicates that the parent contaminant is dissolved radon gas rather than Ra-226. Pb-214 and Bi-214 concentrations in water samples for this project were therefore decay corrected to the time of sample collection using the 3.842 day half life of their parent nuclide, Rn-222. Radon is known to slowly escape from plastic sample containers, therefore the actual concentrations at the time of sampling are likely higher than the measured concentrations. As stated earlier, a replicate analysis on the same sample performed at a later time would be expected to result in somewhat lower measured Pb-214 and Bi-214 concentrations than the initial analysis.
5. **Holding times** – No holding times were specified.

**QUALITY CONTROL**

1. **QC samples** – All QC analysis results met NAREL acceptance criteria.
2. **Instruments** – Response and background checks for all instruments used in these analyses met NAREL acceptance criteria.

## CERTIFICATION

I certify that this data report complies with the terms and conditions of the Quality Assurance Project Plan, except as noted above. Release of the data contained in this report has been authorized by the Director of the Center for Environmental Radioanalytical Laboratory Science and the NAREL Quality Assurance Manager, or their designees, as verified by the following signatures.

Mary Wisdom  
Mary F. Wisdom  
Quality Assurance Manager, NAREL

4-10-12  
Date

John G. Griggs (Acting CERLS Dir)  
John G. Griggs, Ph.D.  
Director, Center for Environmental Radioanalytical  
Laboratory Science

4-11-12  
Date

## GENERAL INFORMATION

### SAMPLE TYPES

BLD	Blind sample
FBK	Field blank
SAM	Normal sample

### ANALYSIS QC TYPES

ANA	Normal analysis
DUP	Laboratory duplicate
LCS	Laboratory control sample (blank spike)
MS	Matrix spike
MSD	Matrix spike duplicate
RBK	Method blank

### QUALITY INDICATORS

RPD	Relative Percent Difference
%R	Percent Recovery
Z	Number of standard deviations by which a QC measurement differs from the expected value

### EVALUATION OF QC ANALYSES

A method blank result is considered unacceptable if it is more than 3 standard deviations below zero or more than 3 standard deviations above a predetermined upper control limit. For some analyses NAREL has set the upper control limit at zero. For others the control limit is a small positive number.

NAREL evaluates the results of duplicate and spike analyses using "Z scores." A Z score is the number of standard deviations by which the QC result differs from its ideal value. The score is considered acceptable if its absolute value is not greater than 3.

The Z score for a spiked sample is computed by dividing the difference between the measured value and the target value by the combined standard uncertainty of the difference.

The Z score for a duplicate analysis is computed by dividing the difference between the two measured values by the combined standard uncertainty of the difference. When the precision of paired MS/MSD analyses is evaluated, the native sample activity is subtracted from each measured value and the net concentrations are then converted to total activities before the Z score is computed.

Each standard uncertainty used to compute a Z score includes an additional fixed term to represent sources of measurement error other than counting error. This additional term is not used in the evaluation of reagent blanks.

NAREL reports the "relative percent difference," or RPD, between duplicate results and the "percent recovery," or %R, for spiked analyses, but does not use these values for evaluation.

## GENERAL INFORMATION (CONTINUED)

### GAMMA ANALYSIS

The reporting format lists the gamma emitters in alphabetical order. The activity, 2-sigma uncertainty, and a sample-specific estimate of the MDC for radionuclides measured by gamma spectroscopy are reported only if the nuclide is detected above background with the exception of client requested nuclides of interest. The activity for each of the requested nuclides is reported whether negative, positive, or zero along with the associated 2-sigma uncertainty.

For this group of samples, NAREL used two different gamma analysis software systems. One system provides a sample-specific estimate of the MDC for every sample result. The other does not. The reader can tell which software was used for a particular sample by looking at the column labeled "MDC."

Due to potential spectral interferences and other possible problems associated with the determination of the activity of certain radionuclides, the activities for Bi-214, Pb-214, Th-234, Pa-234m, Ra-226, Th-231, and U-235 are subject to greater possible uncertainty than other commonly reported radionuclides. It should be noted that this potential uncertainty is not included in the two-sigma counting uncertainty which is reported with each activity. Although in this report we do provide the calculated activities for these radionuclides, we recommend that the results be used only as a qualitative means of indicating the presence of these radionuclides and not as a quantitative measure of their concentration. The results for these nuclides are not used in the evaluation of quality control samples. Furthermore, because of mutual interference between Ra-226 and U-235, NAREL's gamma analysis software tends to overestimate the amounts of these nuclides whenever both are present in a sample. Lower estimates for Ra-226 activities can be obtained from the reported activities of its decay products, Pb-214 and Bi-214, which are likely to be somewhat less than the Ra-226 activity because of the potential escape of radon gas.

NAREL's gamma spectroscopy software corrects activities and MDCs for decay between collection and analysis, but only up to a limit of ten half-lives. So, if the decay time for a sample is more than ten half-lives of a radionuclide, that nuclide will almost always be undetected and the reported MDC will be meaningless. This is usually a problem only for short-lived radionuclides, such as I-131 and Ba-140, when there is a long delay between collection and analysis.

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

**SDG #1200002**

**ANALYSIS SUMMARY**

Analysis Procedure: NAREL GAM-01  
 Title: Gamma Spectrometry

NAREL Sample #	QC Type	Preparation Procedure	Date Completed	Assay Batch #	QC Batch #
B2.02559T		N/A	03/08/2012	0015788B	0008536E
B2.02560K		N/A	03/09/2012	0015788B	0008536E
B2.02560K	DUP	N/A	03/09/2012	0015788B	0008536E
B2.02561L		N/A	03/09/2012	0015788B	0008536E
B2.02617K		N/A	03/09/2012	0015788B	0008536E
B2.02618L		N/A	03/09/2012	0015788B	0008536E
B2.02619M		N/A	03/09/2012	0015788B	0008536E
B2.02675W		N/A	03/14/2012	0015803G	0008555H
B2.02676X		N/A	03/13/2012	0015803G	0008555H
B2.02676X	DUP	N/A	03/14/2012	0015803G	0008555H
LCS-00633006A *	LCS	N/A	03/13/2012	0015788B	0008536E
RBK-00633007B *	RBK	N/A	03/12/2012	0015788B	0008536E
LCS-00633384A *	LCS	N/A	03/18/2012	0015803G	0008555H
RBK-00633385B *	RBK	N/A	03/16/2012	0015803G	0008555H

\* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

**PREPARATION METHOD(S) USED**

Procedure ID	Title

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

**SDG #1200002  
SAMPLE ANALYSIS REPORT**

Sample #:	B2.02559T	QC batch #:	0008536E
Matrix:	WATER-DRINKING	Assay batch #:	0015788B
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.000e+00 L	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	Aqueous		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/08/2012 14:11	300.0	GE14	MO

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Bi212	-5.04e+00	1.1e+01	1.9e+01	PCI/L	03/05/2012 09:36 EST
Bi214 *	7.64e+00	4.1e+00	5.5e+00	PCI/L	03/05/2012 09:36 EST
K40	3.51e+00	1.2e+01	1.9e+01	PCI/L	03/05/2012 09:36 EST
Pb212	2.02e+00	2.3e+00	3.4e+00	PCI/L	03/05/2012 09:36 EST
Pb214 *	2.42e+00	4.5e+00	7.7e+00	PCI/L	03/05/2012 09:36 EST
Ra226 *	-1.06e+00	3.1e+01	4.8e+01	PCI/L	03/05/2012 09:36 EST
Ra228	4.95e-01	3.0e+00	5.0e+00	PCI/L	03/05/2012 09:36 EST
Th234	-1.19e+02	4.0e+03	2.1e+02	PCI/L	03/05/2012 09:36 EST
Tl208	1.72e+00	1.1e+00	1.4e+00	PCI/L	03/05/2012 09:36 EST
U235 *	4.01e-01	9.3e+00	1.6e+01	PCI/L	03/05/2012 09:36 EST

\* An asterisk indicates a result that may be significantly under or overestimated

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SDG #1200002

**SAMPLE ANALYSIS REPORT**

Sample #:	B2.02560K	QC batch #:	0008536E
Matrix:	WATER-DRINKING	Assay batch #:	0015788B
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.000e+00 L	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/08/2012 19:13	300.0	GE14	MO

**ANALYTICAL RESULTS**

Analyte	Activity	± 2 σ Uncertainty	MDC	Unit	Date
Bi212	5.53e-01	2.7e+01	4.5e+01	PCI/L	03/05/2012 16:54 EST
Bi214 *	2.23e+03	2.4e+02	1.2e+01	PCI/L	03/05/2012 16:54 EST
K40	9.30e+00	2.0e+01	2.8e+01	PCI/L	03/05/2012 16:54 EST
Pb214 *	2.47e+03	2.7e+02	1.9e+01	PCI/L	03/05/2012 16:54 EST
Ra226 *	-4.54e+01	2.3e+02	1.3e+02	PCI/L	03/05/2012 16:54 EST
Ra228	-7.07e-01	9.7e-00	1.3e+01	PCI/L	03/05/2012 16:54 EST
Th234	-6.04e-02	3.1e-02	5.2e+02	PCI/L	03/05/2012 16:54 EST
U235 *	1.47e+00	3.0e+01	5.0e+01	PCI/L	03/05/2012 16:54 EST

\* An asterisk indicates a result that may be significantly under or overestimated

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
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**SDG #1200002  
SAMPLE ANALYSIS REPORT**

Sample #:	B2.02560K	QC batch #:	0008536E
Matrix:	WATER-DRINKING	Assay batch #:	0015788B
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.000e+00 L	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	DUP
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/08/2012 14:58	1000.0.	GE06	RCL

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Bi212	-2.89e+01	5.4e+01		PCI/L	03/05/2012 16:54 EST
Bi214 *	2.40e+03	2.8e+02		PCI/L	03/05/2012 16:54 EST
K40	0.00e+00	5.5e+01		PCI/L	03/05/2012 16:54 EST
Pb212 *	-2.74e+02	3.3e+01		PCI/L	03/05/2012 16:54 EST
Pb214 *	2.48e+03	2.9e+02		PCI/L	03/05/2012 16:54 EST
Ra226 *	1.67e+00	9.8e+01		PCI/L	03/05/2012 16:54 EST
Ra228	-1.34e+01	1.9e+01		PCI/L	03/05/2012 16:54 EST
Th234	-7.98e+00	2.1e+02		PCI/L	03/05/2012 16:54 EST
U235 *	-3.34e+01	3.1e+01		PCI/L	03/05/2012 16:54 EST

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**U.S. ENVIRONMENTAL PROTECTION AGENCY  
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**SDG #1200002**

**SAMPLE ANALYSIS REPORT**

Sample #:	B2.02561L	QC batch #:	0008536E
Matrix:	WATER-DRINKING	Assay batch #:	0015788B
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.000e+00 L	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/09/2012 00:15	300.0	GE14	MO

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Bi212	2.19e+00	1.4e+01	2.4e+01	PCI/L	03/05/2012 12:25 EST
Bi214 *	3.35e+02	3.8e+01	7.3e+00	PCI/L	03/05/2012 12:25 EST
K40	-1.69e+01	2.9e+01	2.2e+01	PCI/L	03/05/2012 12:25 EST
Pb214 *	3.58e+02	4.1e+01	1.0e+01	PCI/L	03/05/2012 12:25 EST
Ra226 *	-3.73e+00	5.6e+01	6.8e+01	PCI/L	03/05/2012 12:25 EST
Ra228	1.63e+00	4.0e+00	7.1e+00	PCI/L	03/05/2012 12:25 EST
Th234	-8.60e+01	1.2e+03	2.8e+02	PCI/L	03/05/2012 12:25 EST
U235 *	-6.28e+00	1.5e+01	2.5e+01	PCI/L	03/05/2012 12:25 EST

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**U.S. ENVIRONMENTAL PROTECTION AGENCY  
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SDG #1200002

**SAMPLE ANALYSIS REPORT**

Sample #:	B2.02617K	QC batch #:	0008536E
Matrix:	WATER-DRINKING	Assay batch #:	0015788B
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.000e+00 L	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	Aqueous		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/08/2012 14:58	1000.0	GE03	RCL

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Bi212	1.07e+00	1.4e+01		PCI/L	03/06/2012 14:00 EST
Bi214 *	-6.11e-01	5.0e+00		PCI/L	03/06/2012 14:00 EST
K40	9.74e+00	1.5e+01		PCI/L	03/06/2012 14:00 EST
Pa234m *	1.47e+02	1.5e+02		PCI/L	03/06/2012 14:00 EST
Pb212	-2.41e-01	2.3e+00		PCI/L	03/06/2012 14:00 EST
Pb214 *	-9.75e-01	4.4e+00		PCI/L	03/06/2012 14:00 EST
Ra226 *	1.76e+01	3.0e+01		PCI/L	03/06/2012 14:00 EST
Ra228	-3.85e-01	4.7e+00		PCI/L	03/06/2012 14:00 EST
Th234 *	-3.60e+01	5.5e+01		PCI/L	03/06/2012 14:00 EST
U235 *	-6.70e+00	9.0e+00		PCI/L	03/06/2012 14:00 EST

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**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

**SDG #1200002  
SAMPLE ANALYSIS REPORT**

Sample #:	B2.02618L	QC batch #:	0008536E
Matrix:	WATER-DRINKING	Assay batch #:	0015788B
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.000e+00 L	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/08/2012 14:58	1000.0	GE22	RCL

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Bi212	-6.39e+00	1.9e+01		PCI/L	03/06/2012 15:42 EST
Bi214 *	1.12e+03	1.3e+02		PCI/L	03/06/2012 15:42 EST
K40	1.03e+01	1.6e+01		PCI/L	03/06/2012 15:42 EST
Pb212 *	-1.16e+02	1.4e+01		PCI/L	03/06/2012 15:42 EST
Pb214 *	1.16e+03	1.3e+02		PCI/L	03/06/2012 15:42 EST
Ra226 *	5.19e+00	4.0e+01		PCI/L	03/06/2012 15:42 EST
Ra228	-1.63e+00	5.9e+00		PCI/L	03/06/2012 15:42 EST
Th234	-2.16e+01	6.1e+01		PCI/L	03/06/2012 15:42 EST
U235 *	-9.94e+00	1.3e+01		PCI/L	03/06/2012 15:42 EST

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**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

**SDG #1200002**

**SAMPLE ANALYSIS REPORT**

Sample #:	B2.02619M	QC batch #:	0008536E
Matrix:	WATER-DRINKING	Assay batch #:	0015788B
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.000e+00 L	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/09/2012 10:11	300.0	GE14	MO

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Bi212	3.88e-01	1.4e+01	2.4e+01	PCI/L	03/06/2012 15:42 EST
Bi214 *	9.89e+02	1.1e+02	8.4e+00	PCI/L	03/06/2012 15:42 EST
K40	-1.07e+01	2.8e+01	2.9e+01	PCI/L	03/06/2012 15:42 EST
Pb214 *	1.10e+03	1.2e+02	9.9e+00	PCI/L	03/06/2012 15:42 EST
Ra226 *	1.93e+01	6.0e+01	1.0e+02	PCI/L	03/06/2012 15:42 EST
Ra228	6.52e+00	5.9e+00	7.9e+00	PCI/L	03/06/2012 15:42 EST
Th234	-1.07e+02	1.2e+04	3.9e+02	PCI/L	03/06/2012 15:42 EST
U235 *	1.42e+00	2.2e+01	3.6e+01	PCI/L	03/06/2012 15:42 EST

\* An asterisk indicates a result that may be significantly under or overestimated

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

**SDG #1200002**

**SAMPLE ANALYSIS REPORT**

Sample #:	B2.02675W	QC batch #:	0008555H
Matrix:	WATER-DRINKING	Assay batch #:	0015803G
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.000e+00 L	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	Aqueous		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/13/2012 19:04	300.0	GE14	MO

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Bi212	-3.25e+00	1.1e+01	1.8e+01	PCI/L	03/08/2012 13:38 EST
Bi214 *	1.52e+00	5.5e+00	8.3e+00	PCI/L	03/08/2012 13:38 EST
K40	3.98e+00	1.2e+01	1.9e+01	PCI/L	03/08/2012 13:38 EST
Pb214 *	2.00e+00	6.3e+00	1.1e+01	PCI/L	03/08/2012 13:38 EST
Ra226 *	4.64e-01	2.9e+01	5.0e+01	PCI/L	03/08/2012 13:38 EST
Ra228	-1.36e-01	3.0e+00	5.6e+00	PCI/L	03/08/2012 13:38 EST
Th234	-1.21e+02	1.1e+04	1.9e+02	PCI/L	03/08/2012 13:38 EST
Tl208 *	1.78e+00	1.2e+00	1.5e+00	PCI/L	03/08/2012 13:38 EST
U235 *	1.19e-01	1.1e+01	1.8e+01	PCI/L	03/08/2012 13:38 EST

\* An asterisk indicates a result that may be significantly under or overestimated

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

**SDG #1200002**

**SAMPLE ANALYSIS REPORT**

Sample #:	B2.02676X	QC batch #:	0008555H
Matrix:	WATER-DRINKING	Assay batch #:	0015803G
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	3.000e+00 L	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/13/2012 14:02	300.0	GE14	MO

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Bi212	1.63e+01	1.9e+01	3.1e+01	PCI/L	03/08/2012 15:09 EST
Bi214 *	1.08e+03	1.2e+02	1.2e+01	PCI/L	03/08/2012 15:09 EST
K40	-1.23e+01	2.6e+01	2.6e+01	PCI/L	03/08/2012 15:09 EST
Pb212 *	8.07e+00	3.9e+00	5.5e+00	PCI/L	03/08/2012 15:09 EST
Pb214 *	1.19e+03	1.3e+02	1.8e+01	PCI/L	03/08/2012 15:09 EST
Ra226 *	-3.63e+01	2.4e+02	9.0e+01	PCI/L	03/08/2012 15:09 EST
Ra228	-2.16e+00	1.2e+01	9.5e+00	PCI/L	03/08/2012 15:09 EST
Th234	-1.43e+02	2.3e+03	3.7e+02	PCI/L	03/08/2012 15:09 EST
Tl208 *	2.58e+00	1.7e+00	2.3e+00	PCI/L	03/08/2012 15:09 EST
U235 *	-6.99e+00	2.0e+01	3.3e+01	PCI/L	03/08/2012 15:09 EST

\* An asterisk indicates a result that may be significantly under or overestimated

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

**SDG #1200002**

**SAMPLE ANALYSIS REPORT**

Sample #:	B2.02676X	QC batch #:	0008555H
Matrix:	WATER-DRINKING	Assay batch #:	0015803G
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.000e+00 L	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	DUP
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/13/2012 15:54	1000.0	GE04	MO

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Bi212	1.83e+01	2.4e+01	4.0e+01	PCI/L	03/08/2012 15:09 EST
Bi214 *	9.58e+02	1.1e+02	1.5e+01	PCI/L	03/08/2012 15:09 EST
K40	-1.79e+01	3.3e+01	4.0e+01	PCI/L	03/08/2012 15:09 EST
Pb214 *	1.10e+03	1.2e+02	2.0e+01	PCI/L	03/08/2012 15:09 EST
Ra226 *	-2.17e+01	5.4e+01	7.0e+01	PCI/L	03/08/2012 15:09 EST
Ra228	0.00e+00	6.5e+00	1.1e+01	PCI/L	03/08/2012 15:09 EST
Th234	2.39e+01	6.1e+01	9.9e+01	PCI/L	03/08/2012 15:09 EST
U235 *	-3.35e+00	2.4e+01	2.2e+01	PCI/L	03/08/2012 15:09 EST

\* An asterisk indicates a result that may be significantly under or overestimated

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

**SDG #1200002**

**SAMPLE ANALYSIS REPORT**

Sample #:	LCS-00633006A	QC batch #:	0008536E
Matrix:	N/A	Assay batch #:	0015788B
Sample type:	N/A	Prep procedure:	N/A
Amount analyzed:	1.000e+00 SAMP	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	LCS
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/12/2012 21:02	300.0	GE14	MO

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Bi207	3.71e+03	4.0e+02	1.1e+01	PCI	12/15/2010 11:00 CDT
Co60	1.57e+00	5.1e+00	8.5e+00	PCI	12/15/2010 11:00 CDT
Cs137	5.55e-01	6.7e+00	1.1e+01	PCI	12/15/2010 11:00 CDT
Eu155	8.76e+02	1.2e+02	8.3e+01	PCI	12/15/2010 11:00 CDT
K40	1.03e+02	5.6e+01	7.2e+01	PCI	12/15/2010 11:00 CDT
Ra226 *	4.91e+01	2.2e+02	3.7e+02	PCI	12/15/2010 11:00 CDT
Ra228	9.03e+00	2.7e+01	4.5e+01	PCI	12/15/2010 11:00 CDT

\* An asterisk indicates a result that may be significantly under or overestimated

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

SDG #1200002

**SAMPLE ANALYSIS REPORT**

Sample #:	RBK-00633007B	QC batch #:	0008536E
Matrix:	N/A	Assay batch #:	0015788B
Sample type:	N/A	Prep procedure:	N/A
Amount analyzed:	1.000e+00 SAMP	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	RBK
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/12/2012 10:58	300.0	GE14	MO

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Bi212	5.97e-01	3.6e+01	6.2e+01	PCI	03/08/2012 07:00 CDT
Bi214 *	6.07e+00	8.0e+00	1.1e+01	PCI	03/08/2012 07:00 CDT
K40	9.74e+00	3.0e+01	5.2e+01	PCI	03/08/2012 07:00 CDT
Pb214 *	6.78e+00	6.9e+00	1.0e+01	PCI	03/08/2012 07:00 CDT
Ra226 *	8.84e+01	7.1e+01	1.1e+02	PCI	03/08/2012 07:00 CDT
Ra228	4.14e+00	8.9e+00	1.7e+01	PCI	03/08/2012 07:00 CDT
Th234	-3.43e+02	6.8e+04	5.1e+02	PCI	03/08/2012 07:00 CDT
U235 *	-3.97e-01	2.5e+01	4.2e+01	PCI	03/08/2012 07:00 CDT

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**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

**SDG #1200002**

**SAMPLE ANALYSIS REPORT**

Sample #:	LCS-00633384A	QC batch #:	0008555H
Matrix:	N/A	Assay batch #:	0015803G
Sample type:	N/A	Prep procedure:	N/A
Amount analyzed:	1.000e+00 SAMP	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	LCS
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/17/2012 23:00	300.0	GE14	MO

**ANALYTICAL RESULTS**

Analyte	Activity	± 2 σ Uncertainty	MDC	Unit	Date
Ba140	3.54e+02	4.1e+03	6.8e+03	PCI	12/15/2011 11:00 CDT
Bi207	3.66e+03	4.0e+02	1.2e+01	PCI	12/15/2011 11:00 CDT
Co60	1.13e+00	4.1e+00	6.8e+00	PCI	12/15/2011 11:00 CDT
Cs137	2.74e+00	6.7e+00	1.1e+01	PCI	12/15/2011 11:00 CDT
Eu155	7.50e+02	9.8e+01	6.6e+01	PCI	12/15/2011 11:00 CDT
I131	1.63e+03	3.0e+04	5.0e+04	PCI	12/15/2011 11:00 CDT
K40	1.16e+02	5.7e+01	7.2e+01	PCI	12/15/2011 11:00 CDT
Pa231	3.53e+02	4.0e+02	6.5e+02	PCI	12/15/2011 11:00 CDT
Ra226	*	2.42e+01	2.3e+02	PCI	12/15/2011 11:00 CDT
Ra228	-5.89e-01	2.6e+01	4.1e+01	PCI	12/15/2011 11:00 CDT

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**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

SDG #1200002

**SAMPLE ANALYSIS REPORT**

Sample #:	RBK-00633385B	QC batch #:	0008555H
Matrix:	N/A	Assay batch #:	0015803G
Sample type:	N/A	Prep procedure:	N/A
Amount analyzed:	1.000e+00 SAMP	Analysis procedure:	NAREL GAM-01
Dry/wet weight:	N/A	Analyst:	RCL
Ash/dry weight:	N/A	QC type:	RBK
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
03/16/2012 02:19	300.0	GE14	MO

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2\sigma$ Uncertainty	MDC	Unit	Date
Bi212	3.37e+01	3.4e+01	5.5e+01	PCI	03/13/2012 07:00 CDT
Bi214 *	7.24e+01	1.8e+01	1.9e+01	PCI	03/13/2012 07:00 CDT
K40	3.79e+01	3.1e+01	5.2e+01	PCI	03/13/2012 07:00 CDT
Pb212 *	1.04e+01	6.1e+00	9.3e+00	PCI	03/13/2012 07:00 CDT
Pb214 *	6.24e+01	1.5e+01	1.8e+01	PCI	03/13/2012 07:00 CDT
Ra226 *	3.76e+01	8.4e+01	1.4e+02	PCI	03/13/2012 07:00 CDT
Ra228	1.12e+01	1.1e+01	1.5e+01	PCI	03/13/2012 07:00 CDT
Th234	-2.08e+02	1.2e+03	5.1e+02	PCI	03/13/2012 07:00 CDT
Tl208 *	7.15e+00	4.1e+00	5.0e+00	PCI	03/13/2012 07:00 CDT
U235 *	2.22e-01	3.0e+01	5.0e+01	PCI	03/13/2012 07:00 CDT

\* An asterisk indicates a result that may be significantly under or overestimated

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

**SDG 1200002**

**QC BATCH SUMMARY**

QC batch #: 0008536E

Preparation procedure: N/A

Analysis procedure: NAREL GAM-01

NAREL Sample #	QC Type	Yield (%)	± 2 σ Uncertainty (%)	Analyst
B2.02559T		N/A		RCL
B2.02560K		N/A		RCL
B2.02560K	DUP	N/A		RCL
B2.02561L		N/A		RCL
B2.02617K		N/A		RCL
B2.02618L		N/A		RCL
B2.02619M		N/A		RCL
LCS-00633006A *	LCS	N/A		RCL
RBK-00633007B *	RBK	N/A		RCL

\* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

**SDG 1200002**

**QC BATCH SUMMARY**

QC batch #: 0008555H

Preparation procedure: N/A

Analysis procedure: NAREL GAM-01

NAREL Sample #	QC Type	Yield (%)	± 2 σ Uncertainty (%)	Analyst
B2.02675W		N/A		RCL
B2.02676X		N/A		RCL
B2.02676X	DUP	N/A		RCL
LCS-00633384A *	LCS	N/A		RCL
RBK-00633385B *	RBK	N/A		RCL

\* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

National Air and Radiation Environmental Laboratory  
QC Batch Report

QC Batch #: 0008536E

Analytical Method: NAREL GAM-01

METHOD BLANKS (PCI)

Sample ID	Nuclide	Activity $\pm 2\sigma$	Prep Date	Flags
00633007B	BI212	5.97e-01 $\pm$ 3.6e+01	2012-03-08	OK
00633007B	BI214	6.07e+00 $\pm$ 8.0e+00	2012-03-08	J
00633007B	K40	9.74e+00 $\pm$ 3.0e+01	2012-03-08	OK
00633007B	PB214	6.78e+00 $\pm$ 6.9e+00	2012-03-08	J
00633007B	RA226	8.84e+01 $\pm$ 7.1e+01	2012-03-08	J
00633007B	RA228	4.14e+00 $\pm$ 8.9e+00	2012-03-08	OK
00633007B	TH234	-3.43e+02 $\pm$ 6.8e+04	2012-03-08	OK
00633007B	U235	-3.97e-01 $\pm$ 2.5e+01	2012-03-08	J

LABORATORY DUPLICATES (PCI/L)

Sample ID	Nuclide	Original $\pm 2\sigma$	Duplicate $\pm 2\sigma$	RPD	Z
B2.02560K	BI212	5.53e-01 $\pm$ 2.7e+01	-2.89e+01 $\pm$ 5.4e+01	0.00	-0.98 OK
B2.02560K	BI214	2.23e+03 $\pm$ 2.4e+02	2.40e+03 $\pm$ 2.8e+02	7.56	0.95 OK
B2.02560K	K40	9.30e+00 $\pm$ 2.0e+01	0.00e+00 $\pm$ 5.5e+01	200.00	-0.32 OK
B2.02560K	PB214	2.47e+03 $\pm$ 2.7e+02	2.48e+03 $\pm$ 2.9e+02	0.47	0.06 OK
B2.02560K	RA226	-4.54e+01 $\pm$ 2.3e+02	1.67e+00 $\pm$ 9.8e+01	0.00	0.37 OK
B2.02560K	RA228	-7.07e-01 $\pm$ 9.7e+00	-1.34e+01 $\pm$ 1.9e+01	0.00	-1.19 OK
B2.02560K	TH234	-6.04e-02 $\pm$ 3.1e+02	-7.98e+00 $\pm$ 2.1e+02	0.00	-0.04 OK
B2.02560K	U235	1.47e+00 $\pm$ 3.0e+01	-3.34e+01 $\pm$ 3.1e+01	0.00	-1.63 OK

LAB CONTROL SAMPLES (PCI)

Sample ID	Nuclide	Amt Added $\pm 2\sigma$	Measured $\pm 2\sigma$	%R	Z
00633006A	BI207	3.95e+03 $\pm$ 3.9%	3.71e+03 $\pm$ 4.0e+02	94.07	-1.09 OK
00633006A	CO60	NO SPIKE DATA			
00633006A	CS137	NO SPIKE DATA			
00633006A	EU155	8.57e+02 $\pm$ 5.7%	8.76e+02 $\pm$ 1.2e+02	102.20	0.29 OK
00633006A	K40	NO SPIKE DATA			
00633006A	RA226	NO SPIKE DATA			
00633006A	RA228	NO SPIKE DATA			

Analyst:

RC Lowry  
Lowry, Robert C.

3-19-12

A. Michelle Davis  
3/19/12

QA Officer:

Carol D. McLean

3/19/12

With J flags

MD  
3/19/12

National Air and Radiation Environmental Laboratory  
QC Batch Report

QC Batch #: 0008555H

Analytical Method: NAREL GAM-01

METHOD BLANKS (PCI)

Sample ID	Nuclide	Activity $\pm 2\sigma$	Prep Date	Flags
00633385B	BI212	3.37e+01 $\pm$ 3.4e+01	2012-03-13	OK
00633385B	BI214	7.24e+01 $\pm$ 1.8e+01	2012-03-13	J
00633385B	K40	3.79e+01 $\pm$ 3.1e+01	2012-03-13	WARN
00633385B	PB212	1.04e+01 $\pm$ 6.1e+00	2012-03-13	J
00633385B	PB214	6.24e+01 $\pm$ 1.5e+01	2012-03-13	J
00633385B	RA226	3.76e+01 $\pm$ 8.4e+01	2012-03-13	J
00633385B	RA228	1.12e+01 $\pm$ 1.1e+01	2012-03-13	WARN
00633385B	TH234	-2.08e+02 $\pm$ 1.2e+03	2012-03-13	OK
00633385B	TL208	7.15e+00 $\pm$ 4.1e+00	2012-03-13	J
00633385B	U235	2.22e-01 $\pm$ 3.0e+01	2012-03-13	J

LABORATORY DUPLICATES (PCI/L)

Sample ID	Nuclide	Original $\pm 2\sigma$	Duplicate $\pm 2\sigma$	RPD	Z
B2.02676X	BI212	1.63e+01 $\pm$ 1.9e+01	1.83e+01 $\pm$ 2.4e+01	11.27	0.13 OK
B2.02676X	BI214	1.08e+03 $\pm$ 1.2e+02	9.58e+02 $\pm$ 1.1e+02	12.17	-1.56 OK
B2.02676X	K40	-1.23e+01 $\pm$ 2.6e+01	-1.79e+01 $\pm$ 3.3e+01	0.00	-0.26 OK
B2.02676X	PB214	1.19e+03 $\pm$ 1.3e+02	1.10e+03 $\pm$ 1.2e+02	8.33	-1.06 OK
B2.02676X	RA226	-3.63e+01 $\pm$ 2.4e+02	-2.17e+01 $\pm$ 5.4e+01	0.00	0.12 OK
B2.02676X	RA228	-2.16e+00 $\pm$ 1.2e+01	0.00e+00 $\pm$ 6.5e+00	0.00	0.32 OK
B2.02676X	TH234	-1.43e+02 $\pm$ 2.3e+03	2.39e+01 $\pm$ 6.1e+01	0.00	0.14 OK
B2.02676X	U235	-6.99e+00 $\pm$ 2.0e+01	-3.35e+00 $\pm$ 2.4e+01	0.00	0.23 OK

LAB CONTROL SAMPLES (PCI)

Sample ID	Nuclide	Amt Added $\pm 2\sigma$	Measured $\pm 2\sigma$	%R	Z
00633384A	BA140	NO SPIKE DATA			
00633384A	BI207	3.87e+03 $\pm$ 3.8%	3.66e+03 $\pm$ 4.0e+02	94.64	-0.98 OK
00633384A	CO60	NO SPIKE DATA			
00633384A	CS137	NO SPIKE DATA			
00633384A	EU155	7.45e+02 $\pm$ 5.6%	7.50e+02 $\pm$ 9.8e+01	100.60	0.08 OK
00633384A	I131	NO SPIKE DATA			
00633384A	K40	NO SPIKE DATA			
00633384A	PA231	NO SPIKE DATA			
00633384A	RA226	NO SPIKE DATA			
00633384A	RA228	NO SPIKE DATA			

Analyst:

*Robert C. Lowry*

*4-4-12*

QA Officer:

*Kim J. McEwan*

*4/4/12*

*With J flags.*

*NP  
3/22/12*